

Hymenoptera, Formicidae Latreille, 1809: New records for Atlantic Forest in the state of Rio de Janeiro

Sergio Veiga-Ferreira¹, Guilherme Orsolon-Souza¹ and Antonio José Mayhé-Nunes^{2*}

1 Universidade Federal Rural do Rio de Janeiro, Programa de Pós-Graduação em Biologia Animal. BR 465 km7. CEP 23890-000. Seropédica, RJ, Brazil.

2 Universidade Federal Rural do Rio de Janeiro, Instituto de Biologia, Departamento de Biologia Animal. BR 465 km7. CEP 23890-000. Seropédica, RJ, Brazil.

* Corresponding author. E-mail: amayhe@ufrj.br

ABSTRACT: Standardized sample design helped to increase our knowledge on the ant fauna of Brazilian biomes, in particular leaf litter ants of Atlantic Forest. In this study are presented the new records of nine ant species for the state of Rio de Janeiro: *Amblyopone armigera* Mayr, 1897, *A. elongata* (Santschi, 1912), *Prionopelta punctulata* Mayr, 1866, *Lachnomyrmex plaumanni* Borgmeier, 1957, *Trachymyrmex iheringi* (Emery, 1887), *Pachycondyla arhuaca* Forel, 1901, *P. stigma* (Fabricius, 1804), *Thaumatomyrmex mutilatus* Mayr 1887 and *Proceratium brasiliense* Borgmeier, 1959. They were captured during three systematic inventories carried out in Tinguá Biological Reserve, in Restinga da Marambaia and in Vista Chinesa Forest Reserve. Winkler's extractors and pitfall traps were used as sampling techniques to access ants' fauna.

Ants are known as one of the most diverse and abundant groups of insects in nature. Most known ant species live in the soil and in the leaf litter of tropical forests (Wall and Moore 1999; Silva and Silvestre 2004). Standardized sample design helped to increase our knowledge on the ant fauna of Brazilian biomes, in particular leaf litter ants of Atlantic Forest (see Majer *et al.* 1997; Delabie *et al.* 2000; Veiga-Ferreira *et al.* 2005; Vargas *et al.* 2007). Association of sampling techniques, such as Winkler's extractors and pitfall traps (Olson 1991; Bestelmeyer *et al.* 2000), may sample 75 % of all ant species found in leaf litter, a representative sample for many ecological studies that also allows new records of species.

Our objective in this study was to present new records of nine ant species for the state of Rio de Janeiro, which were captured during three systematic inventories carried out in Tinguá Biological Reserve (Veiga-Ferreira *et al.* 2005), in Restinga da Marambaia (Vargas *et al.* 2007) and in Vista Chinesa Forest Reserve. These researches are parts of ant's fauna inventory for state of Rio de Janeiro, which has been done by Laboratory of Myrmecology of Universidade Federal Rural do Rio de Janeiro (UFRRJ).

We used Winkler's extractors (eW) to collect ants in all three localities and pitfall traps (pf - plastic pots with 32.5 cm in diameter with 100 ml formalin 3 % as fixer liquid) in two localities: Tinguá Biological Reserve (TBR: eW/pf) - Nova Iguaçu municipality (22°34' S, 43°24' W), Vista Chinesa Forest Reserve (VCFR: eW) - Tijuca National Park, Rio de Janeiro municipality (22°58' S, 43°15' W) and Restinga da Marambaia (RM: eW/pf) - Rio de Janeiro municipality (23°03' S, 44°03' W). Sampling protocol for TBR and VCFR can be found in detail in Veiga-Ferreira *et al.* (2005), and for RM in Vargas *et al.* (2007). We distributed 120 pitfall traps over an area of 7,200 m² in RM, 10 m apart from each other. We used 50 Winkler's extractors in TBR, RM and VCFR in an area of 4,800 m² for each place analyzed, with a distance of at least 50 m between adjacent samples.

To see whether there were previous records of the species in Rio de Janeiro, we checked the taxonomical lists by Kempf (1972) and Brandão (1991), the review by Feitosa and Brandão (2008) on *Lachomyrmex*, the review by Baroni-Urbani and De Andrade (2003) on *Proceratium*, and the review by Jahyny *et al.* (2007) on *Thaumatomyrmex*. We identified genera using Bolton's key (1994), subfamilies based on Bolton (2003) and then, in order to determine the species, we used the keys included in the taxonomical reviews of each genus: *Amblyopone* and *Prionopelta* (Brown 1960), *Lachnomyrmex* (Fernández and Baena 1997; Feitosa and Brandão 2008), *Trachymyrmex* (Mayhé-Nunes and Brandão 2005), *Pachycondyla* (Wild 2002; Mackay *et al.* 2007), *Thaumatomyrmex* (Kempf 1975; Jahyny *et al.* 2007) and *Proceratium* (Brown 1979; Baroni-Urbani and De Andrade 2003). All vouchers specimens were deposited in the Coleção Entomológica Ângelo Moreira da Costa Lima (CECL) at the Biology Institute of UFRRJ.

We found four species, ascribed to four families, which had not been previously recorded for the state of Rio de Janeiro (Veiga-Ferreira *et al.* 2005). Vargas *et al.* (2007) collected in RM four more new species, and Feitosa and Brandão (2008) reported another one (Table 1). Out of the seven genera, *Prionopelta* and *Proceratium* have not been recorded for the state yet (Table 2).

Subfamily AMBLYOPONINAE

Genus *Amblyopone* Erichson

Veiga-Ferreira *et al.* (2005) only recorded for the first time the occurrence of this genus in Rio de Janeiro, but did not identify these species. Vargas *et al.* (2007) made the first record of *Amblyopone armigera* Mayr, 1897. We found *A. armigera* (Mayr, 1897) and *A. elongata* (Santschi, 1912) in the three localities. The type locality of the former species is the state of Santa Catarina, Brazil, and of the

TABLE 1. Distribution of nine new records of ant species through sample localities and collecting techniques at state of Rio de Janeiro. Abbreviations: eW = Winkler extractor, pf = pitfall traps, RBT = Reserva Biológica do Tinguá, RFVC = Reserva Florestal da Vista Chinesa, RM = Restinga da Marambaia; * first record of the genus at state of Rio de Janeiro. • Species not known for state of Rio de Janeiro.

SPECIES	RBT		RFVC		RM	
	eW	pf	eW	pf	eW	pf
<i>Amblyopone armigera</i> Mayr	X	X	X	X	X	X
<i>Amblyopone elongata</i> (Santschi)	X	X	X	X	X	X
<i>Lachnomymex plaumanni</i> Borgmeier	X					
<i>Pachycondyla arhuaca</i> Forel						X
<i>Pachycondyla stigma</i> (Fabricius)						X
*• <i>Prionopelta punctulata</i> Mayr	X					
*• <i>Proceratium brasiliense</i> Borgmeier					X	
• <i>Thaumatomyrmex mutilatus</i> Mayr	X				X	
• <i>Trachymyrmex iheringi</i> (Emery)						X

later is Nueva Helvécia, in Uruguay, both located between São Paulo, Brazil, and Cordoba, Argentina (Kempf 1972).

Genus *Prionopelta* Mayr

We collected a single worker of *P. punctulata* Mayr, 1866 in TBR. According to Kempf (1972), the type locality of this species is the state of Paraná; it has been also found in the states of São Paulo and Santa Catarina, Brazil, and in Cordoba, Misiones and Tucumán, Argentina.

Subfamily MYRMICINAE

Genus *Lachnomymex* Wheeler

Veiga-Ferreira et al. (2005) also found this genus for the first time in Rio de Janeiro, without identified the species. We collected workers of *L. plaumanni* Borgmeier, 1957 in TBR. There are specimens from this sample deposited in the Museu de Zoologia, Universidade de São Paulo, included in the list of materials examined by Feitosa and Brandão (2008). Its type locality is Nova Teutônia, in the state of Santa Catarina, Brazil, but it also occurs in the states of Paraná and São Paulo (Kempf 1972). Feitosa and Brandão (2008) stated that *L. Plaumanni* is distributed from Argentina to southeastern Brazil, at altitudes varying between 400-1,200 m.

Genus *Trachymyrmex* Forel

Trachymyrmex iheringi (Emery, 1887) is one of the species of the group Iheringi collected in RM (Vargas et al. 2007), the only record of the group for Rio de Janeiro. This group of species is characterized by antennal scapes that exhibit a small basal lobe (Mayhé-Nunes and Brandão 2005). The genus has a wide Neotropical distribution, but some species are endemic to the Neartic region, occurring from Mexico to the US. *Trachymyrmex iheringi* was restricted to its type locality in São Lourenço, state of Rio Grande do Sul, Brazil (Kempf 1972), but the previously limited distribution of the species, has been extended based on the specimens examined by Mayhé-Nunes and Brandão (2005), and now includes the states of Santa Catarina, São Paulo, Mato Grosso do Sul, Goiás and Brasília.

Subfamily PONERINAE

Genus *Pachycondyla* Fr. Smith

We collected *Pachycondyla arhuaca* Forel, 1901 and *P. stigma* (Fabricius, 1804) in RM. According to Bolton (2003), except for the species originally ascribed to the genus *Pachycondyla*, this genus currently comprises several species that were originally included in other genera of Ponerinae: *Mesoponera*, *Neoponera*, *Termitopone*, *Trachymesopus* and *Wadeura*. The type locality of *P. arhuaca* is San Antonio, Sierra Nevada de Santa Marta, Colombia (Kempf 1972), but this species has already been recorded in the Brazilian states of Amazonas, Espírito Santo and Mato Grosso. The type locality of *P. stigma* is not precisely known (South America), but the species has already been confirmed in Argentina (Formosa), Bolivia and the Brazilian states of Amapá, Amazonas, Pará, Rondônia, Mato Grosso, Pernambuco, Goiás and São Paulo (Kempf 1972). The range of *P. stigma* extends from southeastern US to northeastern Argentina and southeastern Asia (Wild 2002).

Genus *Thaumatomyrmex* Mayr

Veiga-Ferreira et al. (2005) recorded the occurrence of this genus, but did not identify this specie, in the state of Rio de Janeiro, Brazil. We collected workers of *T. mutilatus* Mayr 1887 in the leaf litter in TBR and RM. The type locality of the species is in the state of Santa Catarina, Brazil (Kempf 1972). Besides, its occurrence has been already confirmed in the states of Rio Grande do Sul, São Paulo and Goiás. Kempf (1975) and Jahyny et al. (2007) recorded this species in the Amazon and from northern Argentina to Paraguay.

Subfamily PROCERATIINAE

Genus *Proceratium* Roger

We collected a worker of *P. brasiliense* Borgmeier, 1959 in RM with a Winkler’s extractor. The type locality of the species is Nova Teutônia, in the state of Santa Catarina, Brazil, but it was also reported in the states of São Paulo and Bahia (Baroni-Urbani and De Andrade 2003).

Our data suggest that both Winkler’s extractor and pitfall traps, when used in systematically sample design,

may allow new records of species. However, even if more than one sampling technique is used in an orderly way, some factors related to ant biology may alter sampling efficiency and ants’ records (Wang *et al.* 2001), such as foraging area, nest distribution and activity levels species. Another important factor that must be highlighted is the need for a more intense sampling effort in the northern region of the state of Rio de Janeiro, in order to assess the ant community in this region, what will possibly lead to new species records that, therefore, will provide a new outlook on species distribution in the state.

TABLE 2. Distribution of the nine ant species recorded in Rio de Janeiro, through others Brazilian States and South America countries. ARG = Argentina; COL = Colombia; URU = Uruguay; RS = Rio Grande do Sul; SC = Santa Catarina; PR = Paraná; SP = São Paulo; RJ = Rio de Janeiro; MG = Minas Gerais; ES = Espírito Santo; BA = Bahia; PE = Pernambuco; GO = Goiás; MS = Mato Grosso do Sul; MT = Mato Grosso; RO = Rondônia; TO = Tocantins; PA = Pará; AP = Amapá; AM = Amazonas. # = type locality; ? = probable occurrence.

	<i>Amblyopone armigera</i>	<i>Amblyopone elongata</i>	<i>Lachnomyrmex plaumanni</i>	<i>Pachycondyla arhuaca</i>	<i>Pachycondyla stigma</i>	<i>Prionopelta punctulata</i>	<i>Proceratium brasiliense</i>	<i>Thaumatomyrmex mutilatus</i>	<i>Trachymyrmex iheringi</i>
ARG	x	x			x	x			
COL				#					
URU	?	#			?	?			
RS	x	x			?	?		x	#
SC	#	x	#		?	x	#	#	x
PR	x	x	x		?	#	?	?	x
SP	x	x	x		x	x	x	x	x
RJ	x	x	x	x	x	x	x	x	x
MG				?	?			?	?
ES				x	?			?	?
BA				?	?			?	?
PE					x				
GO				?	x			x	x
MS				?	?				x
MT				x	x				
RO				?	x				
TO				?	?				
PA				?	x				
AP				?	x				
AM				x	x				

ACKNOWLEDGMENTS: We thank CNPq and CAPES for the productivity fellowship granted to AJMN and the graduate scholarship granted to GOS. Dr. Helio Ricardo da Silva made valuable criticisms and suggestions.

LITERATURE CITED

Baroni-Urbani, C. and M.L. de Andrade. 2003. The ant genus *Proceratium* in the extant and fossil record (Hymenoptera: Formicidae). *Museo Regionale di Scienze Naturali-Torino Monografie* 36: 1-492.

Bestelmeyer, B.T., D. Agosti, L.E. Alonso, C.R.F. Brandão, W.L. Brown Jr, J.H.C. Delabie and R. Silvestre. 2000. Field techniques for the study

of ground-living ants: An overview, description, and evaluation; p. 122-144 *In* D. Agosti, J.D. Majer, L.T. Alonso and T. Schultz (ed.). *Ants: Standard methods for measuring and monitoring biodiversity*. Washington: Smithsonian Institution.

Bolton, B. 1994. *Identification guide to the ant Genera of the World*. Cambridge: Harvard University Press. 222 p.

Bolton, B. 2003. Synopsis and classification of Formicidae. *Memoirs of the American Entomological Institute* 71: 1-370.

Brandão, C.R.F. 1991. Adendos ao catálogo abreviado das formigas da Região Neotropical (Hymenoptera: Formicidae). *Revista Brasileira de Entomologia* 35(2): 319-412.

Brown Jr, W.L. 1960. Contributions toward a reclassification of the Formicidae. III. Tribe Amblyoponini (Hymenoptera). *Bulletin of the Museum of Comparative Zoology* 122: 145-178.

Brown Jr, W.L. 1979. A remarkable new species of *Proceratium*, with dietary and other notes on the genus (Hymenoptera: Formicidae). *Psyche* 36: 337-347.

Delabie, J.H.C., D. Agosti and I.C. Nascimento. 2000. Litter ant communities of the Brazilian Atlantic rain forest region. *In* D. Agosti, J.D. Majer, L. Tennant de Alonso and T. Schultz (eds.). *Sampling ground-dwelling ants: case studies from world’s rain forests. Curtin University School of Environmental Biology. Bulletin* 18: 1-17.

Feitosa, R.M. and C.R.F. Brandão. 2008. A taxonomic revision of the Neotropical myrmicine ant genus *Lachnomyrmex* Wheeler (Hymenoptera: Formicidae). *Zootaxa* 1890: 1-49.

Fernández, F. and M.L. Baena. 1997. Hormigas de Colombia VII: Nuevas especies de los géneros *Lachnomyrmex* Wheeler y *Megalomyrmex* Forel. *Caldasia* 19(1-2): 109-114.

Jahyny, B., S. Lacau, J.H.C. Delabie and D. Fresneau. 2007. Le genre *Thaumatomyrmex* Mayr 1887, Cryptique et prédateur spécialiste de Diplopoda Penicillata; p. 329-346 *In*: E. Jiménez, F. Fernández, T.M. Arias-Penna and F.H. Lozano-Zambrano (ed.). *Sistemática, biogeografía y conservación de las hormigas cazadoras de Colombia*. Bogotá: Instituto de Investigación de Recursos Biológicos Alexander von Humboldt.

Kempf, W.W. 1972. Catálogo abreviado das formigas da Região Neotropical (Hymenoptera: Formicidae). *Studia Entomologica* 15: 3-344.

Kempf, W.W. 1975. A revision of the neotropical ponerine ant genus *Thaumatomyrmex* Mayr (Hymenoptera: Formicidae). *Studia Entomologica* 18: 95-126.

Mackay, W.P., E. Mackay, F. Fernández and T.M. Arias-Penna. 2007. Género *Pachycondyla* F. Smith; p. 170-218 *In* Jiménez, E., F. Fernández, T.M. Arias-Penna and F.H. Lozano-Zambrano (ed.). *Sistemática, biogeografía y conservación de las hormigas cazadoras de Colombia*. Bogotá: Instituto de Investigación de Recursos Biológicos Alexander von Humboldt.

Majer, J.D., J.H.C. Delabie and N.L. Mckenzie. 1997. Ant litter fauna of forest, forest edges and adjacent grassland in the Atlantic rain forest region of Bahia, Brazil. *Insectes Sociaux* 44: 255-266.

Mayhé-Nunes, A.J. and C.R.F. Brandão. 2005. Revisionary studies on the attine ant genus *Trachymyrmex* Forel. Part 2: The Iheringi group (Hymenoptera: Formicidae). *Sociobiology* 45: 271-305.

Olson, D.M. 1991. A comparison of the efficacy of litter sifting and pitfall traps for sampling leaf litter ants (Hymenoptera: Formicidae) in a Tropical wet forest, Costa Rica. *Biotropica* 23(2): 166-172.

Silva, R.R. and R. Silvestre 2004. Riqueza da fauna de formigas (Hymenoptera: Formicidae) que habita as camadas superficiais do solo em Seara, Santa Catarina. *Papéis Avulsos de Zoologia* 44(1): 1-11.

Vargas, A.B., A.J. Mayhé-Nunes, J.M. Queiroz, G.O. Souza and E. Folly-Ramos. 2007. Efeitos de Fatores Ambientais sobre a Mirmecofauna em Comunidade de Restinga no Rio de Janeiro, RJ. *Neotropical Entomology* 36(1): 28-37.

Veiga-Ferreira, S., A.J. Mayhé-Nunes and J.M. Queiroz. 2005. Formigas de serapilheira na Reserva Biológica do Tinguá, Estado do Rio de Janeiro, Brasil (Hymenoptera: Formicidae). *Revista Universidade Rural, Série Ciências da Vida* 25(1): 49-54.

Wang, C., J. Strazanac and L. Butler. 2001. A comparison of Pitfall Traps with Bait Traps for studing leaf litter ant communities. *Journal Economic Entomology Lanham* 94(3): 761-765.

Wall, D.H. and J.C. Moore. 1999. Interactions underground. *BioScience* 49: 109-117.

Wild, A.L. 2002. The genus *Pachycondyla* (Hymenoptera: Formicidae) in Paraguay. *Boletín Museo Nacional de la Historia Naturales del Paraguay* 14(1-2): 1-18.

RECEIVED: September 2009
REVISED: March 2010
ACCEPTED: May 2010
PUBLISHED ONLINE: September 2010
EDITORIAL RESPONSIBILITY: Amazonas Chagas Junior